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CLOSE-OUT RADIOLOGICAL SURVEY PLAN FOR THE 123 CLUSTER

REVISION 4

Rocky Mountain Remediation Services, L.L.C.

March 1998

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This Close-Out Radiological Survey Plan has been reviewed and approved by:

C. L. Guthrie, Project Manager, RMRS — Date: 3/31/98

J. Masse, Quality Assurance, RMRS — Date: 4-8-98

J. B. Barroso, Manager, Radiological Engineering, RMRS — Date: 3/30/98

T.L. Vaughn, Manager, Radiological Engineering, SSOC — Date: 3/30/98

R. S. Roberts, Radiological Engineering, SSOC — Date: 3/30/98

This Close-Out Radiological Survey Plan was prepared by:

J. J. Miller, Radiological Engineer, RMRS — Date: 3/30/98

M. Rodriguez, Radiological Engineer, RMRS — Date: 3/30/98

CLOSE-OUT RADIOLOGICAL SURVEY PLAN
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APPENDICES

ATTACHMENTS

1.0 Correspondence

a) Department of Energy Memorandum AME:ESD:TPD:04909, Keith Klein to Wynn Harding, entitled "Surface Contamination Guidelines for Building 123," dated 12/5/97

b) Safe Sites of Colorado Interoffice Correspondence JJM-111-97, J.J. Miller to File, entitled "Derived Contamination Guideline Level (DCGL) For Beta Contamination During Final Surveys of the Interior of Building 123," dated 11/18/97

c) Kaiser-Hill Correspondence 97-RF-05729, Wynn Harding to David Lowe, entitled "Department of Energy (DOE) Order 5400.5 Figure IV-1 - Surface Contamination Guidelines and the Application of These Limits Towards Naturally Radioactive Decay Chains and the Ingrowth of Progeny From Purified Naturally Occurring Radioisotopes," dated 11/4/97

d) cc:mail Correspondence, John Miller to Mark Mattheiss, entitled "Background For B123 Final Surveys," dated 3/16/98

e) cc:mail Correspondence, John Miller to Mark Mattheiss, entitled "B123 Background Determination," dated 3/17/98

f) Rocky Mountain Remediation Services Interoffice Memorandum JJM-11-98, J.J. Miller to File, entitled "Survey Unit Specific Background Count Rate (SUSBCR) Determination For Building 123 Final Surveys," dated 3/24/98

CLOSE-OUT RADIOLOGICAL SURVEY PLAN FOR THE 123 CLUSTER

1.0 PURPOSE

The purpose of the Close-Out Radiological Survey Plan (CRSP) is to define the methods for collecting, analyzing, and documenting data to demonstrate that residual radioactive material existing in Buildings 123, 113 and 114 are below levels established in the Final Rocky Flats Cleanup Agreement (RFCA) identified in Appendix A, (Figure IV-1, Surface Contamination Guidelines, Department of Energy (DOE) 5400.5, 2-8-90). Those areas that contain radioactive material above the unrestricted release criteria will be decontaminated to meet the release criteria, managed as radioactive material or released in a restricted manner.

2.0 DESCRIPTION

2.1 FACILITY HISTORY

2.1.1 Building 123

Building 123 is located on Central Avenue between Third and Fourth Streets. The original building has been in use since construction in 1953, with additions completed in 1968, 1972, and 1974. The general areas of the building and respective approximate construction dates are:

East and North Wing (Rooms 100-135) - 1952
Addition to East Wing (Rooms 139-151) - 1968
West Wing (Rooms 154-163) - 1972
Addition to East Wing (Room 165) - 1974

Currently, the 75-room, single-level facility covers approximately 19,000 square feet and is constructed on grade with approximately fourteen- (14-) foot ceilings. Construction material is mostly concrete with an asphalt roof. Modifications have been made to the building interior after the original construction of each area. Areas have been remodeled including installation and removal and partition walls, laboratory fixtures and other items. Sections of piping have been installed, removed and modified during the life of the facility.

Building 123 was one of the first ten buildings constructed at Rocky Flats. Analytical laboratory, dosimetry and instrument calibration activities have been conducted in Building 123 since construction in 1953. Building 123 also provided office space for radiation health specialists; storage for all radiological health records; a laboratory for calibration and repair of criticality alarms and other repair/calibration shops. Building 123 once housed medical research until such operations were relocated to Building 122.

The analytical laboratory analyzed environmental (air, water, soil, and vegetation); biological (urine, fecal matter, and nasal mucous); health physics (room air); and industrial hygiene samples (beryllium and organic vapors in room air). The Health Physics Instrumentation Section repaired and calibrated radiation-detection instruments. The External Dosimetry Section processed thermoluminescent dosimeters and film badges. The Radiological Records Section maintained occupational radiation exposure and dose records for radiation workers.

The analytical laboratory procedures involved the digestion of samples to purify and concentrate the radiological constituents. Various sample waste and rinse solutions were washed down the process drain for subsequent treatment in Building 774 (Building 374 after 1983). Liquid organic wastes were containerized in special bottles and stored in satellite accumulation areas prior to transfer to the RCRA 90-day storage building and eventual shipment to Liquid Waste Operations. Wastes generated in Non-Radioactive Material Management Areas and monitorable lab trash

were deposited in dumpsters for disposal in the Rocky Flats Environmental Technology Site (RFETS) landfill.

2.1.2 Building 113

Building 113 is a guardhouse that has been converted into office space. The building encloses approximately 200 square feet. It is constructed of concrete with a flat roof, Building 113 is similar to the four other guardhouses that have already been removed from RFETS.

2.1.3 Building 114

Building 114 is a small shelter used by RFETS employees as a waiting area for off-site transportation. The building encloses approximately 25 square feet. It is constructed of masonry blocks with a flat roof. There are no utilities associated with this building, and records indicate the building has served no other function.

2.1.4 Building 123S

Building 123S is a metal shed on a concrete slab. It was formerly used as a RCRA 90-day storage area and as a Radioactive Material Storage Area. The 123 Cluster Demolition Project includes the removal of this building, however, since this building is considered property, it will be released for unrestricted use in accordance with Health and Safety Practice (HSP) Site Procedure 1-P73-HSP-18.10, Radioactive Material and Unrestricted Release of Property and Waste and will be excluded from the CRSP for the 123 Cluster.

3.0 SCOPE OF DECOMMISSIONING CLOSE-OUT RADIOLOGICAL SURVEYS

The surveys for Buildings 123, 113 and 114 will include floors, interior wall surfaces, accessible surfaces of the roof, exterior wall surfaces and fixed equipment.

The scope of Building 123 Decommissioning Project CRSP as defined in this document is to:

- Provide a description of the graded approach used in determining the intensity of sampling and survey data gathering which must be obtained to make the determination that Buildings 123, 113 and 114 meet the release criteria of Appendix A. Those levels identified in Appendix A are equivalent to the Derived Concentration Guideline Level (DCGL).

- State how the characterization data obtained will be used to support the final decommissioning decision.

- Develop a survey and sampling approach which, when implemented, will obtain information to adequately demonstrate that Buildings 123, 113 and 114 have no contamination levels above the unrestricted release levels stated in Appendix A.

- State the criteria which will be used to release Buildings 123, 113 and 114 for unrestricted use.

The 123 Cluster Demolition Project does not include building slabs or the abandoned source wells. Prior to building demolition, residual radioactivity identified in the slab or source wells will be remediated or immobilized so that there is no removable contamination in excess of the release criteria identified in Appendix A. The Building 123 source wells are excluded for the 123 Cluster CRSP and will then be dealt with at a later date.

4.0 FINAL SURVEY STRATEGY

4.1 IDENTIFYING THE POTENTIAL FOR RESIDUAL RADIOACTIVITY AND CONTAMINANTS OF CONCERN

4.1.1 Building 123

During the past forty-four (44) years, building operations (primarily analytical laboratory operations) may have contributed to the deposition of varying degrees of radioactive contamination within the building. The presence of radioactive contamination above the unrestricted release criteria was confirmed in Rooms 105, 106, and 109 during the reconnaissance level characterization surveys of the building. During the initial final survey of the east wing, there was also confirmed radioactive contamination above the unrestricted release criteria The potential for undetected residual radioactivity in excess of the release criteria varies throughout the building. Area classification and the extent of final surveys weigh heavily on this potential.

Determination of the contaminants of concern for Building 123 was accomplished through, (1) a review of historical records (2) interviews with past and present RFETS employees having first hand knowledge on the processes that had taken place during the building's history, (3) waste characterization reports and (4) in-situ gamma spectroscopy.

Interviews with employees revealed that a cesium spill had occurred in Room 109 and undocumented thorium research was performed in Room 105. Scoping surveys revealed elevated levels of radioactivity in both areas. In-situ gamma spectroscopy confirmed the presence of cesium and thorium. Refer to Summary Report of In-Situ Gamma Spectroscopy for Building 123 for analysis results.

The following contaminants have been identified for Building 123:

- Pu-242, Pu-239, U-232, U-234, U-238, Am-241 and Cm-244; radioactive tracers used during bioassay analysis.
- Cs-137, spill, Room 109, confirmed via in-situ gamma spectroscopy.
- Th-232 and associated decay products, research and development Room 105, confirmed via in-situ gamma spectroscopy.

The following isotopes mentioned in the Reconnaissance Level Characterization Report for Building 123 have been ruled out as potential contaminants of concern:

- H-3, in the form of HTO in concentrations up to 1000 dpm/ml used as a standard for liquid scintillation analysis. A review of the Historical Release Report for the Rocky Flats Plant, Manual No. 21100-TR-12501.01 and interviews with past building occupants failed to identify spills or releases involving tritium. If an undocumented spill had occurred, it is highly unlikely that residual tritium contamination would exceed the release criteria because the process of evaporation and relatively short half-life would limit the resulting contamination levels.
- H-3, in the form of HT gas is not expected to result in surface contamination.
- Ni-63, Sr-90, Ba-133, Gd-148, Pb-210 and Cf-250 in the form of electroplated and sealed check sources. The integrity of electroplated and sealed sources are verified semi-annually in accordance with HSP 1-P21-HSP-18.04, Control of Radioactive Sources and are not expected to result in radioactivity contamination of the building. Additionally, the DCGL for

alpha and beta contamination identified for final surveys are at least as restrictive as the release criteria for these radionuclides.

During final strip-out of room 105, a pure beta emitter was found. This beta emitter is currently being identified. The identity of this radionuclide will be delineated in the Close-Out Radiological Survey Report.

4.1.2 Building 113

Process history was used in lieu of scoping surveys for the classification of Building 113. Based on the past and current use Building 113 is not expected to contain any residual radioactivity and has been designated as Class 3.

4.1.3 Building 114

Process history was used in lieu of scoping surveys for the classification of Building 114. Based on the past and current use, Building 114 is not expected to contain any residual radioactivity and has been designated as Class 3.

4.2 SURVEY GROUPS

4.2.1 Definition

As referenced in this CRSP, a Survey Group is defined as an area or collection of areas which have a common history or other characteristics, or are naturally distinguishable from other portions of the site. Survey Groups are partitioned into one or more Survey Units (Section 4.3). Eleven Survey Groups have been identified for the 123 Cluster.

4.2.2 Purpose

Survey Groups have been identified for the 123 Cluster to (1) facilitate survey design, (2) tracking Final Survey status and (3) to organize collected survey data.

Because the potential for residual contamination may vary throughout an area, interior areas comprising a Survey Group may be subdivided into separate Survey Units. The exteriors of Buildings 123, 113 and 114 are not subdivided. It is assumed that any residual radioactivity external to each building would have been deposited uniformly across each external plane as a result of a release of radioactivity elsewhere onsite.

The methodology behind this grouping is not described in the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) or NUREG/CR-5849, but has been developed for this project in an effort to aid in the final decision process.

4.3 SURVEY UNITS

4.3.1 Definition

As referenced in this CRSP, a Survey Unit is defined as a subdivision of a Survey Group which has a similar potential for residual radioactivity based on process history and/or survey data. Nineteen Survey Units have been identified for the 123 Cluster.

4.3.2 Purpose

Survey units have been identified for the 123 Cluster to assure that the number of survey data points for a specific site are relatively uniformly distributed among areas of similar contamination potential.

4.3.3 Limitations

As recommended by MARRSIM, survey units have been limited in size to ensure each area is assigned an adequate number of data points. The suggested maximum areas for survey units are 100 m^2 for Class 1 areas and 1000 m2 for Class 2 areas. There is no size limit for Class 3 areas. Special consideration is given to Survey Units of less than 10 m2. In this case, the number of data points obtained from statistical tests are unnecessarily large and not appropriate for smaller survey units. All survey units will approximate or be less than the MARSSIM suggested values.

4.4 CLASSIFICATION

4.4.1 Definition(s)

Non-impacted Area: Areas that have no reasonable potential for residual contamination.

Class 1 Area: Areas that have, or had, a potential for radioactive contamination (based on site operating history) or known contamination (based on previous radiation surveys) above the DCGL.

A survey unit has been designated Class 1 if: (1) Radiological surveys identify radioactive contamination in excess of the DCGL and/or, (2) based on process history, there is a potential for radioactive contamination in excess of the DCGL.

Class 2 Area: Areas that have, or had, a potential for radioactive contamination or known contamination, but are not expected to exceed the DCGL.

A survey unit has been designated Class 2 if: (1) Radiological surveys failed to identify radioactive contamination in excess of the DCGL, and (2) based on process history, radioactive contamination may be present but is not expected to exceed the DCGL.

Class 3 Area: Any impacted areas that are not expected to contain any residual radioactivity, or are expected to contain levels of residual radioactivity at a very small fraction of the DCGL, based on site operating history and previous radiation surveys.

A survey unit has been designated Class 3 if: (1) Radiological surveys failed to identify radioactive contamination, and (2) based on process history, radioactive contamination may be present but at levels which are a small fraction of the DCGL.

4.4.2 Purpose

As previously mentioned, the potential for undetected residual radioactivity in excess of the release criteria varies throughout the building. Area classification and the extent of final surveys weigh heavily on this potential. Results of the scoping and characterization surveys, summarized in the Reconnaissance Level Characterization Report for Building 123, and the initial final surveys were reviewed along with the process history to determine the classification for a given survey unit.

The internal portions of the potable water, fire main and steam systems have been designated as non-impacted. These systems are supplied with a clean pressurized water source, there is no reasonable potential for these systems to have become contaminated. In addition, there are several pressurized gas systems (air, N2, Ar and natural gas) which served Building 123, because these systems were operated at pressures exceeding atmospheric, there is no reasonable potential for these systems to have become contaminated. The process cold water system and health physics vacuum system will be investigated and dispositioned in accordance with Site Procedure 1-P73-HSP-18.10, Radioactive Material Transfer and Unrestricted Release of Property and Waste.

All impacted designations referenced by MARSSIM, with the exception of Class 2, have been applied to areas within Building 123. Buildings 113 and 114 are designated as Class 3, no distinction is drawn above and below 2 meters. Survey densities for MARSSIM Class 1 and 3 areas were established using NUREG/CR-5849 criteria.

It is assumed that if radioactive contamination exists on the exterior of the buildings, it would have been deposited as a result of a release from a process facility and would have been evenly distributed across the surface of the building. The exterior portions of Buildings 123, 113 and 114 are not expected to contain any residual radioactivity, therefore, these areas have been designated as Class 3.

Classifications of areas may be changed during in-process surveying based on survey results and sound judgment by Radiological Engineering. Initial classification of survey units as well as the survey units themselves have been changed from Revision 1 of this CRSP as a result of the identification of residual radioactivity in excess of the release criteria during the initial performance of Final Surveys in the east wing of Building 123. Survey densities are summarized below:

4.4.3 Survey and Sampling Requirements

Class 1 Impacted (Affected) Areas: A minimum of one fixed alpha and beta total surface activity measurement for each one square meter. A minimum of one alpha and beta removable activity measurement for each one square meter. A 100% alpha and beta scan will be performed on accessible surfaces.

Class 2 Impacted (Affected) Areas: One fixed alpha and beta total surface activity measurement per MARSSIM statistical requirements. One alpha and beta removable activity measurement per MARSSIM statistical requirements. A 10 - 100% alpha and beta scan will be performed on accessible surfaces per MARSSIM requirements.

Class 3 Impacted (Unaffected) Areas: One fixed alpha and beta total surface activity measurement every 50 m2 or 30 points, whichever is greater. One fixed alpha and beta total surface activity measurement every 50 m2 or 30 points, whichever is greater. A 10% alpha and beta scan based on total survey surface area will be performed on selected biased locations.

Non-impacted: No survey requirements.

5.0 UNRESTRICTED RELEASE OF THE 123 CLUSTER

5.1 RADIOLOGICAL RELEASE CRITERIA

The unrestricted release criteria are presented in Appendix A. Plutonium-239 is the most limiting alpha emitting contaminant common to all survey units identified in the 123 Cluster. In addition to meeting the release criteria for transuranics, survey data obtained on the external surfaces of Buildings 123, 113 and 114 and the interior surfaces of Buildings 113 and 114 will be verified less than the beta-gamma release criteria. In addition to meeting the release criteria for transuranics,

survey data obtained from the interior survey units of Building 123 will be verified less than 75% the release criteria for Thorium-232 (beta) (Reference Kaiser-Hill Memo 97-RF-05729, Appendix D).

The Th-232 release criteria will be used for the currently unknown beta emitter present in rooms 103 and room 105 for conservatism. As a result of a Cesium-137 spill, affecting Rooms 109, 109A and 109B of Building 123, the survey units encompassing these areas will also be verified less than the release criteria for beta-gamma emitters. External gamma radiation measurements will not be performed during final surveys because the 123 Cluster is slated for demolition (Reference Section IV.4.c. of DOE Order 5400.5). Volume contaminated material will be evaluated against the DOE No-Rad-Added Program. The survey methods and release criteria of Appendix A are in conformance with the following RFETS procedures:

4-K62-ROI-03.01	Performance of Surface Contamination Surveys
4-S23-ROI-03.02	Radiological Requirements for Unrestricted Release
4-Q97-REP-1003	Radiological Evaluation for Unrestricted Release of Property/Waste
1-P73-HSP-18.10	Radioactive Material Transfer and Unrestricted Release of Property and Waste
4-U50-REP-1006	Radiological Characterization of Bulk or Volume Materials

5.2 EVALUATING AREAS OF ELEVATED ACTIVITY

Individual measurement results will be compared against the average and the maximum release criteria in Appendix A. Measurement results less than the average guideline value will be deemed acceptable. Measurement results greater than the maximum guideline value will indicate a need for remediation. Measurement results greater than the average guideline value but less than the maximum release criteria will require investigation to determine if the average of that measurement along with eight additional measurements in one square meter (centered about the original measurement) exceeds the average release criteria. These eight measurements will be obtained as follows; a 3X3 array of sample points will be taken with the elevated measurement at the center and all points will be spaced 0.25 meters apart. If the average of these measurements exceed the average guideline value, remediation will be necessary. If the average of these measurements are less than the average guideline value, no further action will be necessary.

6.0 SITE ASSESSMENT

6.1 SEVEN STEP DATA QUALITY OBJECTIVE PROCESS

The following seven step process derived from Environmental Protection Agency (EPA) QA/G-4, The Data Quality Objective Process and the Draft MARSSIM is being utilized to develop a CRSP for the 123 Cluster. The CRSP was designed to identify the survey requirements which, when completed, will demonstrate compliance with the Appendix A release criteria. A portion of these survey requirements have been met by In-Process characterization surveys.

Step 1

Why perform this survey?

This survey is being performed to assure that Buildings 123, 113 and 114 materials to be released contain no radioactive contamination above the unrestricted release criteria outlined in Appendix A.

What types and kind of sampling measurements are required?

The radiological surveys required to assure that the unrestricted release criteria is met are fixed and removable surveys for both gross alpha and gross beta contamination. These surveys are performed at distinct locations throughout the buildings. Since small areas of radioactive material may be present between the fixed and removable surveys, scan surveys will also be performed. These surveys are performed across defined areas of the buildings per Appendix B.

Building media samples will be obtained at distinct locations to verify building materials are free of residual radioactive material resulting from DOE operations.

Who needs the information?

DOE, EPA, Colorado Department of Public Health and the Environment, Stakeholders, Kaiser-Hill, Safe Sites of Colorado and Rocky Mountain Remediation Services will use the CRSP results to assure that, following demolition, the building rubble can be released in an unrestricted manner.

When is the information needed?

The survey results from the CRSP are needed before the demolition of Building 123, 113 and 114.

Step 2

What decisions will be made from this final survey information?

Structures and components of the 123 Cluster will be released in an unrestricted manner when it is shown that the criteria identified in Appendix A are met.

If the surveys show that portions of the 123 Cluster do not meet the unrestricted release criteria, the area exceeding the criteria will be decontaminated or removed. The decontaminated area will then be resurveyed to assure that the unrestricted release criteria is met. If the unrestricted release criteria cannot be met, the area exceeding the criteria will not be released for unrestricted use. In the event of slab contamination a temporary cover will be placed over the affected area that will protect the area from damage during demolition and removal of rubble.

Are there any alternatives to the decision?

There are no other alternatives for the 123 Cluster. The Site Utilization Review Board and DOE Management have made the decision that these buildings are excess.

What is the end use of the equipment, facility or structure (free release, restricted use, low-level waste, etc.)?

Structures and components within Building 123 which have no radioactive material contamination above the unrestricted release criteria, may be released for unrestricted use. Materials shown to contain radioactive material above the unrestricted release criteria which are not decontaminated, will be disposed of as low-level waste. It is not anticipated that materials with residual radioactivity in excess of the release criteria will be released for restricted use.

Step 3

What information is required to make this decision?

The information required are the radiological survey data and building media sample results that will support a decision to release the building materials and fixtures for unrestricted use. Fixed and removable surveys for both gross alpha and gross beta contamination are required. These surveys are performed at distinct locations within the building. Since radioactive material may be present between the locations where fixed and removable surveys will be taken, scan surveys will also be performed. These scan surveys are performed so that the probability of finding radioactive material above the unrestricted release criteria is maximized. These scan surveys are performed across a defined area within the building. Refer to Appendix B for survey instructions.

What source(s) can be used to obtain the information?

Reconnaissance level characterization surveys, in-process characterization surveys and initial final surveys. If these surveys do not satisfy the requirements of the CRSP, additional surveys will be required so that the requirements of the CRSP are met.

Can the desired analyses be performed at RFETS or will the analysis be sent off-site?

All radiological survey data will be obtained and recorded within the building by qualified radiological control technicians. This data will be reviewed at RFETS. Building media samples may be analyzed on-site or sent off-site for analysis by a qualified laboratory.

What type of instrumentation will be required?

The following instrumentation will be used to perform all radiological surveys. The Minimum Detectable Activities (MDA) of the instruments used to perform the surveys required in this CRSP will be a fraction of the unrestricted release criteria outlined in Appendix A. A goal will be to have the MDA of an instrument at or below 50% of the unrestricted release criteria.

Instrument	Count Time	Max Background	Application	MDA (dpm/100 cm2)
Bicron w/A100 Probe	60 sec.	2 cpm	Direct Alpha Surveys (Total Alpha Activity)	55
NE Electra w/ DP6 Probe	60 sec.	8 cpm alpha 700 cpm beta	Direct Alpha and Beta Surveys (Total Activity)	93.3(1) 455
Shonka Research Associates	(2)	(2)	Direct Alpha and Beta Surveys (Total Activity)	50 - Alpha 375 - Beta

(SRA) Monitor				
SAC-4	120 sec.	1 cpm	Removable Alpha Swipes	<12
Tennelec Series 5	120 sec.	1 cpm alpha 10 cpm beta	Simultaneous Removable Alpha and Beta Swipes	(3)

(1) The MDA will be calculated based on actual background and calibration efficiency in order to achieve an MDA at or below 50% of the unrestricted release criteria
(2) The MDA for the SRA monitor will meet the above MDA requirements. The MDA for the SRA monitor is calculated after surveys are performed taking into account the Count Time and Local Area Background.
(3) The MDA for this instrument is calculated on a daily basis and is dependent on the calibrated efficiency and daily background check. Typical alpha and beta MDA values for a two minute count are <7.5 dpm/100 cm2 and <10 dpm/100 cm2 respectively.

Has facility structural data been reviewed?

Structural data is not applicable to this CRSP since the building is slated for demolition.

What suspect materials have been identified?

Plutonium, Americium, Uranium, Thorium, Curium and Cesium have been identified as radioisotopes that may be present in Building 123. An unknown pure beta emitter has been found in rooms 103 and 105. The identity of this radioisotope is being evaluated.

Step 4

What is the scope of this final survey?

The interior floors, walls, ceilings and fixed equipment inside Buildings 123, 113 and 114 will be surveyed. The extent of these surveys will vary throughout the buildings and will be dependent on the potential for residual radioactivity. The exterior walls and roofs of the buildings will be surveyed. Building media samples will be obtained as needed to determine the presence of residual radioactivity. Residual radioactivity in the building slab, source wells, and surrounding soils will be evaluated and remediated, if necessary at a later date.

What is the sample population of interest?

The floors, walls, ceiling and fixed equipment located within the interior of the building and the exterior walls of the building are the population of interest.

What kind of radiological hazard is being evaluated?

Radioactive material present on the surface that is fixed and/or removable needs to be evaluated. Gross alpha and gross beta measurements will be taken to evaluate the radiological hazard. Additionally, radioactive material that may have migrated into or sealed over needs to be evaluated. Building media samples will be obtained and analyzed for gross alpha and beta radioactivity and isotopically as necessary.

Are there any constraints on data collection?

Data collection is performed in accordance with the requirements of:

NUREG/CR-5849 - Manual for Conducting Radiological Surveys in Support of License Termination.

Draft MARSSIM - Multi-Agency Radiation Survey and Site Investigation Manual.

The survey methods utilized are in conformance with specific sample analysis plans and the following RFETS and instrumentation specific procedures:

4-K62-ROI-03.01	Performance of Surface Contamination Surveys
4-S23-ROI-03.02	Radiological Requirements for Unrestricted Release
4-Q97-REP-1003	Radiological Evaluation for Unrestricted Release of Property/Waste
1-P73-HSP-18.10	Radioactive Material Transfer and Unrestricted Release of Property and Waste
4-U50-REP-1006	Radiological Characterization of Bulk or Volume Materials

Shonka Research Associates Surface Contamination Monitor (SCM) Procedures:
1. SCM Procedure 001, Rev 0, "Calibration and Field Confirmatory Tests of the Incremental Encoder Included on the SCM"
2. SCM Procedure 004, "Completion of Gross Alpha, Beta and Dose Rate Surveys"
3. SCM Procedure 003, Rev 1, "Calibration Requirements for the SCM Efficiencies"
4. SCM Procedure 007, Rev 0, "Response Check of any PSPC Detector Configuration Installed on the SCM"

What sample measurement locations (densities) are necessary to get the desired certainty?

All areas of the building cluster do not have the same potential for radioactive material being present and, therefore, do not require the same level of survey coverage to achieve an appropriate level of confidence that building surfaces satisfy the unrestricted release criteria. The CRSP is designed so that areas with higher potential for contamination receive a higher degree of survey effort. This will ensure that the CRSP is both effective and efficient.

The following area classifications with their associated survey frequencies are based on guidance from:

NUREG/CR-5849 - Manual for Conducting Radiological Surveys in Support of License Termination.

Draft MARSSIM - Multi-Agency Radiation Survey and Site Investigation Manual.

Four area classifications were used to design the 123 Cluster CRSP. These classifications are defined as follows:

Class 1 Impacted (Affected) Areas: Are areas that have potential contamination (based on building operating history) or known contamination (based on past or preliminary characterization survey data). This would normally include areas where radioactive materials were used and stored and where records indicate spills or other unusual occurrences could have resulted in the spread of contamination. The survey frequency will be a minimum of one fixed survey measurement and one removable survey measurement per square meter. In addition, an alpha/beta scan survey of 100% of the applicable surface areas, including fixed equipment, is required.

Class 2 Impacted (Affected) Areas: Are areas that have or had a potential for radioactive contamination or known contamination, but are not expected to exceed the applicable contamination limits. The survey frequency will be determined utilizing MARSSIM statistical

calculations. In addition, a scan survey for alpha and beta of 10 -100% of the applicable surface areas, including fixed equipment, will be performed as required by MARSSIM.

Class 3 Impacted (Unaffected) Areas: Are all areas not classified as Class 1 or Class 2 Impacted or Non-Impacted. These areas are not expected to contain residual contamination above the applicable limits, based on knowledge of building history and previous survey information. However, insufficient documentation is present to exclude the area from survey requirements. The survey frequency will be a minimum of one fixed survey measurement and one removable survey measurement per 50 square meters or 30 points, whichever is greater. In addition, an alpha/beta scan survey of 10% of the applicable surface areas, including fixed equipment, is required.

Non-impacted: Are areas having no reasonable potential for residual contamination. There are no survey requirements associated with non-impacted areas.

Step 5

What is the basis for the decision in Step 2?

The unrestricted release criteria outlined in Appendix A is the basis for deciding whether the structures and components of Buildings 123, 113 and 114 can be released in an unrestricted manner.

The survey frequency required to allow an unrestricted release is based on guidance from:

NUREG/CR-5849 - Manual for Conducting Radiological Surveys in Support of License Termination.

Draft MARSSIM - Multi-Agency Radiation Survey and Site Investigation Manual.

Are there any regulatory and statistical drivers for sampling frequency?

The survey frequency required to allow an unrestricted release is based on guidance from:

NUREG/CR-5849 - Manual for Conducting Radiological Surveys in Support of License Termination.

Draft MARSSIM - Multi-Agency Radiation Survey and Site Investigation Manual.

1-P73-HSP-18.10 - Radioactive Material Transfer and Unrestricted Release of Property and Waste

4-U50-REP-1006 Radiological Characterization of Bulk or Volume Materials

What are the required instrumentation sensitivities?

The MDA of the instruments used to perform the surveys required in this CRSP will be a fraction of the unrestricted release criteria outlined in Appendix A. A goal will be to have the MDA of an instrument at or below 50% of the unrestricted release criteria. Instrument scanning speeds for alpha contamination will be slow enough (See Appendix D) to ensure a small diameter (point) source detection frequency greater than 50% at the guideline levels, as recommended by ANSI N13.12, Draft American National Standard: Control of Radioactive Surface Contamination on Materials, Equipment, and Facilities to be Released for Uncontrolled Use. Additionally, each instrument will have a greater than 90% probability of observing a second event within a static

count time of 6 seconds. Instrument scanning speeds for beta contamination follow the recommendations of the draft MARSSIM in Section 6.4.2, "Scanning Sensitivity."

What action levels are applicable to the decision or parameter of interest?

The unrestricted release criteria is outlined in Appendix A.

Define the decisions using "if...then" statements.

IF the structures and components of Buildings 123, 113 and 114 contain no radioactive material above the unrestricted release criteria, **THEN** those components may be released for unrestricted use.

IF the structures and components of Buildings 123, 113 and 114 contain radioactive material above the unrestricted release criteria, **THEN** those components will be decontaminated or removed.

IF decontaminated structures and components of Buildings 123, 113 and 114 contain radioactive material above the unrestricted release criteria, **THEN** those components will not be released for unrestricted use.

IF removed materials (structures and components) are radioactively contaminated, **THEN** those removed materials will not be released for unrestricted use.

Step 6

What sample size is necessary for the analysis being completed?

The sample size is defined for different survey units based on the classification of their associated subdivisions. Refer to Appendix B for detailed survey instructions.

What is the expected range of the parameter of interest?

All parameter values are expected to be less than the unrestricted release criteria outlined in Appendix A.

Define both types of decision errors, (false negative and false positive)?
False negative (Type 1) errors would occur when a detector's response is below the unrestricted release criteria when, in fact, radioactive material is present above the unrestricted release criteria.

False positive (Type 2) errors would occur when a detector's response is above the unrestricted release criteria when, in fact, radioactive material is not present above the unrestricted release criteria.

What are the potential consequences of an incorrect decision?

For false negative errors, area/material would be released in an unrestricted manner when it should not be released in an unrestricted manner.

For false positive errors, area/material would not be released in an unrestricted manner when it should be released in an unrestricted manner.

What are the limits on decision errors?

The survey frequency required in Appendix B is not based on a minimum statistical confidence.

Step 7

What method will be used to obtain the desired information?

The survey methods to be utilized are in conformance with specific sample analysis plans and the following RFETS and instrumentation specific procedures:

4-K62-ROI-03.01	Performance of Surface Contamination Surveys
4-S23-ROI-03.02	Radiological Requirements for Unrestricted Release
4-Q97-REP-1003	Radiological Evaluation for Unrestricted Release of Property/Waste
1-P73-HSP-18.10	Radioactive Material Transfer and Unrestricted Release of Property and Waste
4-U50-REP-1006	Radiological Characterization of Bulk or Volume Materials

Shonka Research Associates Surface Contamination Monitor (SCM) Procedures:
1. SCM Procedure 001, Rev 0, "Calibration and Field Confirmatory Tests of the Incremental Encoder Included on the SCM"
2. SCM Procedure 004, "Completion of Gross Alpha, Beta and Dose Rate Surveys"
3. SCM Procedure 003, Rev 1, "Calibration Requirements for the SCM Efficiencies"
4. SCM Procedure 007, Rev 0, "Response Check of any PSPC Detector Configuration Installed on the SCM"

How will the survey design be optimized?

Areas which have a common history or other characteristics, or are naturally distinguishable from other portions of the site have been partitioned into Survey Groups. Survey Groups are further subdivided based on contamination potential into Survey Units. Measurement locations will be clearly identified to provide a method of referencing survey results to survey measurement locations. Gridding will be used for the floors and walls for areas designated as Class 1 or 2 for final classification only. Grids may be marked by paint, a chalk line, or labels at grid locations. In areas where gridding is not practical or cost effective, measurement locations will be marked with labels or similar method or delineated on a map as directed by Radiological Engineering.

Have data quantity and quality assurance requirements for sampling been reviewed and incorporated into the survey process?

Quality assurance is addressed in Section 8.0 of this CRSP. The survey reports are prepared and reviewed in accordance with RFETS procedures.

7.0 RESPONSIBILITIES

7.1 PROJECT MANAGER

The Project Manager is responsible for reviewing and approving Building 123 Decommissioning Project CRSP and Report.

7.2 RADIOLOGICAL ENGINEERING

Radiological Engineering is responsible to:

- Evaluate the project structures and appropriately classify the areas for survey.
- Develop overall technical aspects, planning, and scheduling for implementation of the Close-Out Radiological Survey.
- Define the content and ensure preparation of Building 123 Decommissioning Project Close-Out Radiological Survey Report (CRSR).
- Develop, review, and approve Property/Waste Release Evaluations (P/WRE).
- Resolve issues regarding survey layout and gridding requirements.
- Review and approve Building 123 Decommissioning Project CRSP and Report.
- Ensure that the Close-Out Radiological Survey is developed and consistent with RFETS requirements.
- Test the null hypothesis and determine if additional surveys are required.

7.3 RADIOLOGICAL CONTROL TECHNICAL SUPERVISOR

The Radiological Control Technical Supervisor is responsible to:

- Ensure Radiological Control Technicians assigned to perform radiological surveys have been trained and qualified to the applicable Site procedures .
- Review surveys and sample analysis results for completeness, accuracy, and legibility. Ensure discrepancies in survey data are identified and corrected.

7.4 RADIOLOGICAL CONTROL TECHNICIANS

The Radiological Control Technicians are responsible to:

- Perform surveys in accordance with this plan, approved RFETS procedures, and direction provided by the Radiological Engineer.
- Provide complete, accurate, and legible documentation for all surveys performed.

8.0 QUALITY ASSURANCE (QA)

8.1 SURVEY DOCUMENTATION

Records of the survey will be maintained in a survey package. The survey package will be the primary method of controlling and tracking close-out radiological survey results. The records compiled in a survey package will include:

- Completed Contamination Survey Results (Fixed and Removable)
- Completed PREs
- Survey Area Diagrams/Maps
- Printout of Smear Survey Analysis
- Laboratory Analysis Results
- Data Analysis Summary
- Completed Chain of Custody Forms

8.2 CHAIN OF CUSTODY (COC)

Samples will be managed to ensure that there is an accurate record of sample collection, transport, analysis, and disposal. This will insure that samples are neither lost nor tampered with and that the sample analyzed is traceable to a specific location in the field. COC documentation shall be completed for all samples submitted for laboratory analysis. The COC form will be included as part of the close-out radiological survey documentation.

8.3 ANALYTICAL LABORATORY QA/QUALITY CONTROL (QC)

All samples collected for special analysis will be analyzed by RFETS laboratories or an approved contracted laboratory. The analysis will be performed by trained individuals using appropriate equipment and procedures. The laboratory will have analytical capabilities for the radionuclides of interest (Plutonium, Americium, Uranium, Thorium, Curium and Cesium) and an established QA/QC program which assures the validity of the analytical results. The laboratory analytical methods will be capable of measuring levels below the established release criteria. All results will state the detection limit for the analysis.

9.0 REPORTING SURVEY FINDINGS

A CRSP Report will be prepared at the conclusion of the project. The report will be prepared by the Decommissioning Radiological Engineer and the cognizant SSOC Radiological Engineer. All measurements will be reported in units appropriate for comparison with Appendix A surface contamination limits. Total and removable surface activity measurements will be reported in units of dpm per 100 cm2. A summary of the following measurement results and overall conclusions showing that the building surfaces meet the release criteria will be provided.

- Total Surface Beta-Gamma Activity
- Total Surface Alpha Activity
- Removable Surface Beta-Gamma Activity
- Removable Surface Alpha Activity
- Gross Alpha and Beta Activity of Building Material Samples
- Isotopic Abundances of the Contaminants of Concern From Building Material Samples

The 95% confidence level will be used to further demonstrate attainment of the release limits once the individual measurements have demonstrated compliance with the release criteria. The confidence level will be calculated using normal statistics (one-tailed test) at the 95% confidence level. In addition, the upper confidence limit (UCL) about the mean (95% confidence level) will be reported for comparison to the release criteria.

10.0 REFERENCES

NUREG/CR-5849 - Manual For Conducting Radiological Surveys In Support Of License Termination (Draft).

MARSSIM - Multi-Agency Radiation Survey And Site Investigation Manual (Draft).

Site Procedure 4-K62-ROI-03.01, Performance Of Surface Contamination Surveys.

Site Procedure 4-S23-ROI-03.02, Radiological Requirements For Unrestricted Release.

Site Procedure 4-Q97-REP-1003, Radiological Evaluation For Unrestricted Release Of Property/Waste.

Site Procedure I-P73-HSP-18.10, Radioactive Material Transfer And Unrestricted Release Of Property And Waste.

Site Procedure 4-U50-REP-1006, Radiological Characterization of Bulk or Volume Materials

Reconnaissance Level Characterization Report For The Building 123, RF/RMRS-97-021, August 1997.

Decommissioning Program Plan, Draft, July 1997.

DOE, 1996, Final Rocky Flats Cleanup Agreement, Rocky Flats Environmental Technology Site, Golden, CO.

Radiological Engineering Site Operations Technical Basis Document, Methods to Demonstrate Compliance with Performance Requirements for Swipe Counting and Portable Contamination Survey Instrumentation used to Evaluate Property and Waste for Unrestricted Release, Rocky Flats Environmental Technology Site, June 7, 1995.

Summary Report of In-Situ Gamma Spectroscopy in Building 123, Prepared for SEG, Colorado by GTS Duratek, September 26, 1997.

No-Radioactivity -Added (NRA) Waste Verification Program, EG&G Rocky Flats Plant, September 1993.

Shonka Research Associates Surface Contamination Monitor (SCM) Procedures:

1. SCM Procedure 001, Rev 0, "Calibration and Field Confirmatory Tests of the Incremental Encoder Included on the SCM"
2. SCM Procedure 004, "Completion of Gross Alpha, Beta and Dose Rate Surveys"
3. SCM Procedure 003, Rev 1, "Calibration Requirements for the SCM Efficiencies"
4. SCM Procedure 007, Rev 0, "Response Check of any PSPC Detector Configuration Installed on the SCM"

Appendix A

Surface Contamination Guidelines

Table A-1 Surface Contamination Guidelines

Allowable Total Residual Surface Contamination (dpm/100 cm2)[1]			
Radionuclides[2]	Average[3,4]	Maximum[4,5]	Removable[4,6]
Transuranics, I-125, I-129, Ra-226, Ra-228, Ac-227, Th-228, Th-230, Pa-231	100[8]	300[8]	20[8]
Th-Natural, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000	3,000	200
U-Natural, U-235, U-238, and associated decay products, alpha emitters.	5,000	15,000	1,000
Beta-gamma emitters, (radionuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.[7]	5,000	15,000	1,000

1 As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute measured by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

2 Where surface contamination by both alpha and beta-gamma emitting radionuclides exist, the limits established for alpha and beta-gamma emitting radionuclides should apply independently.

3 Measurements of average contamination should not be averaged over an area of more than 1 m2. For objects of less surface area, the average should be derived for each object.

4 The average and maximum dose rates associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hour and 1.0 mrad/hour, respectively, at 1 cm.

5 The maximum contamination level applies to an area of not more than 100 cm2.

6 The amount of removable material per 100 cm2 of surface area should be determined by wiping an area of that size with a dry filter of soft absorbent paper, applying moderate pressure, and measuring the amount of radioactive material on the wiping with an appropriate instrument of known efficiency. When removable contamination on objects of surface area less than 100 cm2 is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. It is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate the total residual surface contamination levels are within the limits for removable contamination.

7 This category of radionuclides includes mixed fission products, including the Sr-90 which is present in them. It does not apply to Sr-90 which has been separated from the other fission products or mixtures where the Sr-90 has been enriched.

8 DOE 5400.5 lists these values as "Reserved". These limits have been taken from the Nuclear Regulatory Commission Regulatory Guide 1.86, as directed by DOE/RFO Memorandum, May 11, 1993, RPB:FJJ:05220, Phase III of Moratorium on Release of Materials For Unrestricted Use.

Appendix B

Radiological Survey Instructions

Activity Hazard Analysis-Radiological Surveys for the 123 Cluster

Principle Steps	Potential Hazards	Control Measure
1. Performance checking instruments	a. Handling radioactive check sources, b. Work with electrical equipment.	a. Radioactive check sources leak checked semi-annually. b. Electrical safety checks performed during instrument calibration.
2. Performing contamination surveys	a. Construction hazards, b. Confined space entry, c. Work in overhead and on roof tops, d. Back strains, slips, trips and falls, e. Work in potentially contaminated areas, f. Sharp objects.	a. PPE steel-toed shoes, hard hats and safety glasses. Workers briefed on construction activities. b. Controlled IAW 1-E36-HSP-6.04, Confined Space Entry. c. Use of ladders, scaffolds and fall protection controlled IAW 1-K59-HSP-22.02, Ladders, 1-B54-HSP-22.03, Scaffolds and HSP 22.05, Fall Protection and Equipment. d. Workers trained on proper bending and lifting. Workers aware of surroundings. e. Follow governing RWP. f. Leather gloves
3. Analyzing swipes	a. Work with electrical equipment, b. Pinching hazard, c. Handling potentially contaminated swipes.	a. Electrical safety checks performed during instrument calibration. b. Ensure guard is in place when operating Tennelec. c. Only trained and qualified individuals analyze swipes.

SURVEY GROUPS 1, 2 and 3

Due to the wide spread contamination identified on the floor tile during initial final surveys, a decision was made based to remove the asbestos containing floor tile and interior walls of Building 123 as low level waste and, in accordance with Section 4.4.2, Radiological Engineering revised the Survey Units and Classifications accordingly. The East Wing (Survey Group 1) has been broken down into Survey Units 1, 2, 3, 4 and 5. The West Wing (Survey Group 2) has been broken down into Survey Units 6, 7 and 8. And the North Wing (Survey Group 3) has been broken down into Survey Units 9, 10 and 11. As a result of the contamination identified during the initial phase of final surveys, the floors of Survey Group 1 have been designated as Class 1. Although no contamination was identified on the walls during characterization and the initial final surveys, the walls below 2 meters have also been designated as Class 1 to ensure sufficient survey scan coverage. The walls above 2 meters and ceiling are not expected to contain residual radioactivity and have been designated as Class 3. Classifications, grid criteria and survey densities are summarized below:

Radiological Surveys (2)							
Survey Unit	Area (1)	Class	Grid	Paint Samples (4)	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
1, 2, 3, 4, 6, 7, 9, 10	Floors Wall (< 2 m)	1	1 m^2	–	Minimum of 1/grid	Minimum of 1/grid	100%
5,8,11	Wall (> 2 m) Ceiling	3	No	–	Minimum of one per 50 m^2 or 30, whichever is greater	Minimum of one per 50 m^2 or 30, whichever is greater	10%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

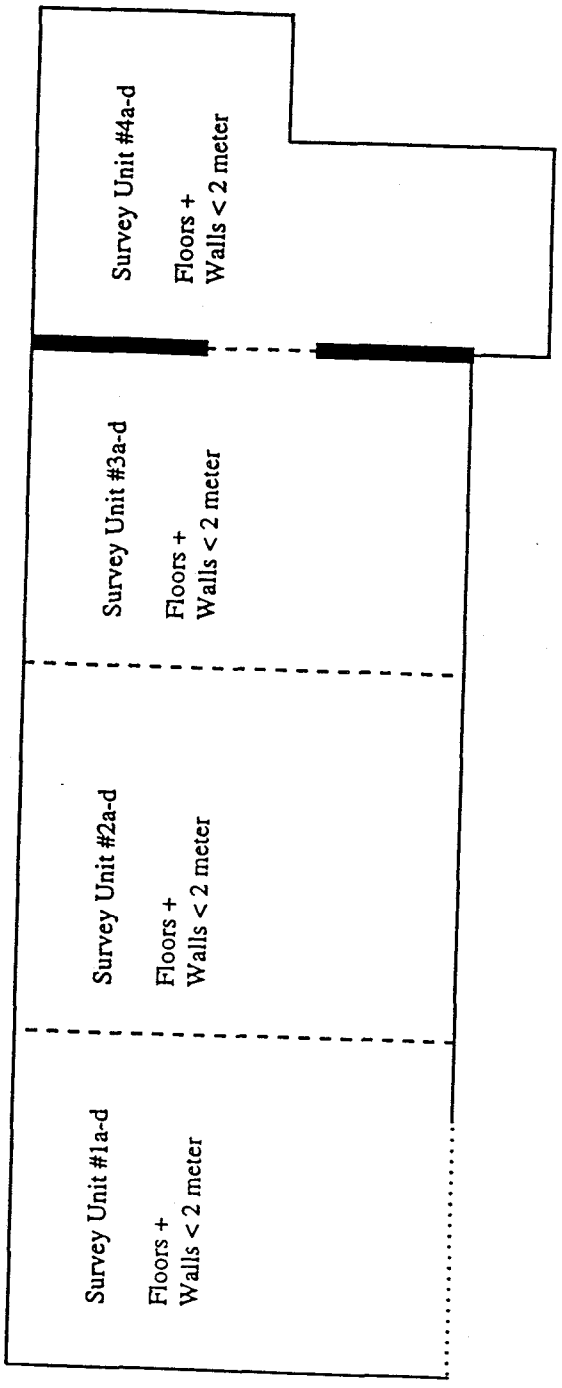
The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

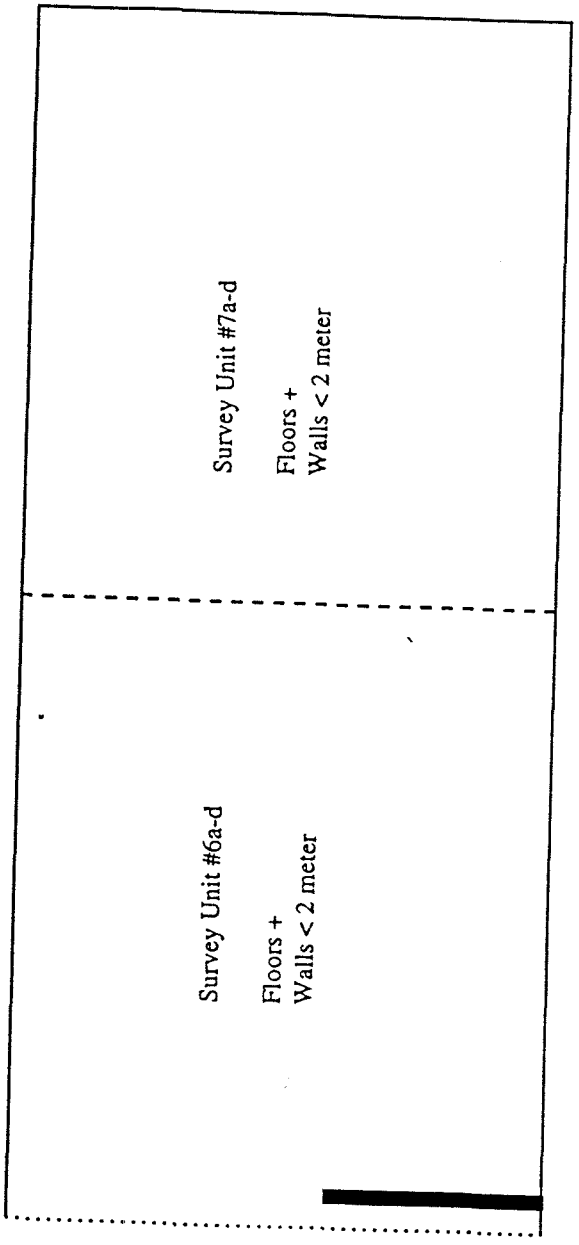
(4) 5 paint samples per wall in each laboratory (samples compiled) and 3 paint samples per control area. Release determination will be in accordance with 4-U50-REP-1006, Radiological Characterization of Bulk or Volume Materials.

EAST WING SURVEY UNITS
SURVEY GROUP #1

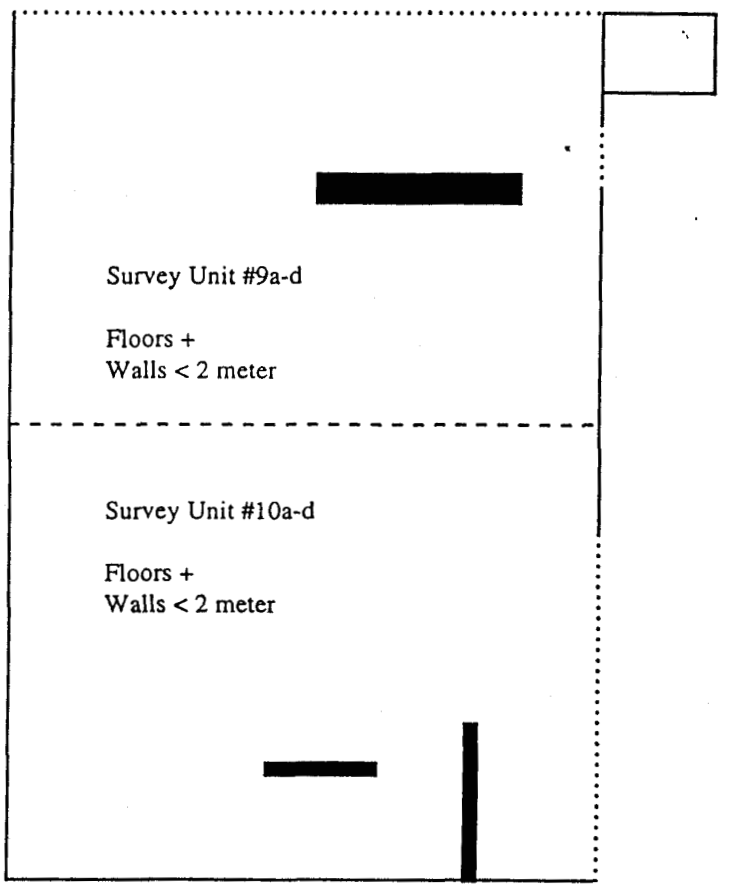


Survey Unit #5: Walls > 2 meter + Ceiling

WEST WING SURVEY UNITS
SURVEY GROUP #2



NORTH WING SURVEY UNITS
SURVEY GROUP #3



Survey Unit #11: Walls > 2 meter + Ceiling

SURVEY GROUP 4

Survey Group 4 consists of a Pipe Chase located between the men's and women's locker rooms. This area is controlled as a confined space, entry is gained through a small door labeled 332-023 from the North hallway in Building 123. This area is not expected to contain residual radioactivity and has been designated as Class 3. Classification, grid criteria and survey densities are summarized below:

Radiological Surveys (2)						
Survey Unit	Area (1)	Class	Grid	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
12	Floors	3	No	Minimum of 30	Minimum of 30	10%
	Wall (< 2 m)	3	No	Minimum of 3/plane	Minimum of 3/plane	10%
	Wall (> 2 m) Ceiling	3	No	Minimum of 1/plane	Minimum of 1/plane	10%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

SURVEY GROUP 5

Survey Group 5 consists of three process waste sumps, located in Rooms 156, 157 and 158 in Building 123. These sumps are controlled as confined spaces and have not been entered for the purposes of characterization. The potential exists for these areas to contain residual radioactivity in excess of the DCGL and have been designated as Class 1. Classification, grid criteria and survey densities are summarized below:

Radiological Surveys (2)						
Survey Unit	Area (1)	Class	Grid	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
13	Floors	1	1 m^2	Minimum of 1/grid	Minimum of 1/grid	100%
	Walls	1	1 m^2	Minimum of 5/plane	Minimum of 5/plane	100%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

SURVEY GROUP 6

Survey Group 6 consists of the interiors in Buildings 113 and 114. Building 113 is a guardhouse that has been converted into office space. The building encloses approximately 200 square feet. Building 114 is a small shelter used by RFETS employees as a waiting area for off-site transportation. The building encloses approximately 25 square feet. It is constructed of masonry blocks with a flat roof. There are no utilities associated with this building, and records indicate the building has served no other function. Residual radioactivity is not expected in either of these buildings therefore both buildings have been designated as Class 3. Classification, grid criteria and survey densities are summarized below:

Radiological Surveys (2)						
Survey Unit	Area (1)	Class	Grid	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
14	Building 113	3	No	Minimum of 30	Minimum of 30	10%
15	Building 114	3	No	Minimum of 30	Minimum of 30	10%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

(4) A minimum of 30 fixed and removable data points will be obtained for each Survey Unit.

SURVEY GROUP 7

Survey Group 7 consists of the Building 123 room non-process ventilation system which handled routine HVAC. The building ventilation system is not expected to contain residual radioactivity and has been designated as Class 3. Classification, grid criteria and survey densities are summarized below:

Radiological Surveys (2)						
Survey Unit	Area (1)	Class	Grid	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
16	System	3	No	Minimum of 30	Minimum of 30	10%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

SURVEY GROUP 8

Survey Group 8 consists of sanitary drains. The sanitary drains are not expected to contain residual radioactivity in excess of the release criteria. Classification, grid criteria and survey densities are summarized below:

Radiological Surveys (2)						
Survey Unit	Area (1)	Class	Grid	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
17	System	3	No	1 per Drain	1 per Drain	10%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

SURVEY GROUP 9

Survey Group 9 consists of the exterior of Building 123. The exterior of Building 123 is not expected to contain residual radioactivity and has been designated Class 3. Classification, grid criteria and survey densities are summarized below:

Radiological Surveys (2)							
Survey Unit	Area (1)	Class	Grid	Roof Samples	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
18	Exterior Walls	3	No	N/A	Minimum of 90/wing	Minimum of 90/wing	10%
	Roof	3	No	5/wing (4)	Minimum of 90/wing	Minimum of 90/wing	10%
	Supply Ventilation Plenums (3)	3	No	N/A	Minimum of 15/plenum (interior)	Minimum of 15/plenum (interior)	10%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

(4) 5 roof samples per wing. Release determination will be in accordance with 4-U50-REP-1006, Radiological Characterization of Bulk or Volume Materials.

SURVEY GROUP 10

Survey Group 10 consists of the exterior of Building 113. The exterior of Building 113 is not expected to contain residual radioactivity and has been designated Class 3. Classification, grid criteria and survey densities are summarized below:

Radiological Surveys (2), (4)						
Survey Unit	Area (1)	Class	Grid	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
19	Exterior Walls	3	No	Minimum of 5/plane	Minimum of 5/plane	10%
	Roof	3	No	Minimum of 10	Minimum of 10	10%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

(4) A minimum of 30 fixed and removable data points will be obtained for each Survey Unit.

SURVEY GROUP 11

Survey Group 11 consists of the exterior of Building 114. The exterior of Building 114 is not expected to contain residual radioactivity and has been designated Class 3. Classification, grid criteria and survey densities are summarized below:

Radiological Surveys (2)						
Survey Unit	Area (1)	Class	Grid	# Removable alpha / beta survey measurements	# Direct alpha / beta survey measurements	Scan Survey (3)
20	Exterior Walls	3	No	Minimum of 5/plane	Minimum of 5/plane	10%
	Roof	3	No	Minimum of 10	Minimum of 10	10%

Notes:

(1) See attached map for building layout.

(2) Surveys are to be performed in accordance with 4-K62-ROI-03.01, Performance of Surface Contamination Surveys, with the exception that actual observed values will be recorded when measurements are below the instrument MDA. Background values for the surface media and general area will be subtracted from the instrument readings, as appropriate (See Appendix C). Removable and Direct alpha/beta surveys will be performed prior to the required scan survey, as appropriate.

The Shonka Research Associates Surface Contamination Monitor (SCM) surveys will be performed per the instrument specific procedures. When using the SCM for "total" surveys, the "total" measurement will be performed concurrently with the scan survey.

(3) Perform an alpha and beta scan (refer to Appendix D for scan instructions) survey over the percentage of the accessible surfaces as listed, including fixed equipment/systems, paying particular attention to horizontal surfaces. Scan surveys are performed in areas having the highest potential for residual radioactivity. Document scan surveys by performing direct and removable alpha/beta measurements at locations where the net count rate corresponds to a level which equals the Derived Concentration Guideline Level (DCGL) (100 dpm /100 cm2 alpha and 750 dpm /100 cm2 beta). If previously obtained fixed and removable contamination surveys adequately document the scan, no further measurements are necessary. If no readings in excess of the DCGL were obtained during the scan, document this fact on the survey map cover sheet, further documentation is not required. Record direct and removable alpha/beta measurements obtained during the scan survey in accordance with Note (2) above.

When using the SCM for scan surveys, the SCM generated printout will be used to document the contamination levels present. The SCM scan surveys of the walls will only be to 6 feet.

(4) A minimum of 30 fixed and removable data points will be obtained for each Survey Unit.

Appendix C

Determination of Survey Unit Background For Direct Measurement and Scan Surveys

Determination of Survey Unit Background For Direct Measurement and Scan Surveys

A Survey Unit Specific Background Count Rate (SUSBCR) for alpha and beta will be determined daily for each instrument used for the final surveys of an individual survey unit. Reference Area Background will be determined daily in bldg. 551 until an adequate number of data points have been obtained and analyzed by Radiological Engineering. Building 551 was determined to be representative of building 123 based on its structural characteristics and age.

The following actions will be taken to obtain this background:

Within the Survey Unit:

1) The Radiological Control Technician (RCT) will obtain ten (10) one minute counts, (i.e. NE Electra operated in the integrate mode), randomly throughout survey unit on walls and the slab.
2) At each background location, the RCT will place a 3/4 inch thickness of plywood, large enough to cover the detector probe, onto the surface to be surveyed. The detector probe will be placed directly onto the plywood shield and obtain a 1 minute PAT.
3) Instruments, individual background count rates and average background count rate will be recorded on the SUSBCR, and will be included with the final survey.

Reference Area:

1) Use the previously determined values for reference area background.

Calculation:

1) Calculate the SUSBCR for concrete materials and all other materials using the equations provided on the SUSBCR Calculation Sheet.

Use:

1) SUSBCRs will be determined for each instrument used. The instrument specific SUSBCR will only be applied to survey points obtained with that instrument.

2) SUSBCR will be applied appropriately to the material being surveyed. Material specific backgrounds will be derived for concrete only. All other materials are assumed to have a negligible background component. Therefore, only the local area background within the survey unit will be applied when surveying surfaces other than concrete or cinder block.

Survey Unit Specific Background Count Rate Calculation Sheet

ALPHA (α)

Survey Unit :		Serial # :		α Efficiency :		RadioNuclide :	α
Date :		Cal. Due Date :		β Efficiency :		RCT Initial :	
Survey Unit plywood shield	"A" (cpm)	Reference Area (unshielded)	"B" (cpm)	Reference Area plywood shield	"C" (cpm)	Difference	("B" - "C") (cpm)
Background (1)		Background (1)	N/A	Background (1)	N/A	N/A	N/A
Background (2)		Background (2)	N/A	Background (2)	N/A	N/A	N/A
Background (3)		Background (3)	N/A	Background (3)	N/A	N/A	N/A
Background (4)		Background (4)	N/A	Background (4)	N/A	N/A	N/A
Background (5)		Background (5)	N/A	Background (5)	N/A	N/A	N/A
Background (6)		Background (6)	N/A	Background (6)	N/A	N/A	N/A
Background (7)		Background (7)	N/A	Background (7)	N/A	N/A	N/A
Background (8)		Background (8)	N/A	Background (8)	N/A	N/A	N/A
Background (9)		Background (9)	N/A	Background (9)	N/A	N/A	N/A
Background (10)		Background (10)	N/A	Background (10)	N/A	N/A	N/A
Average ("A")						Average ("B" - "C")	1.42

SUSBCR (concrete mt'ls) =Average ("A") _____ plus Average ("B" - "C") 1.42 cpm
SUSBCR (concrete mt'ls) = _____
SUSBCR (all other mt'ls) =Average ("A") _____
SUSBCR (all other mt'ls) = _____

BETA (β)

Survey Unit :		Serial # :		α Efficiency :		RadioNuclide :	β
Date :		Cal. Due Date :		β Efficiency :		RCT Initial :	
Survey Unit plywood shield	"A" (cpm)	Reference Area (unshielded)	"B" (cpm)	Reference Area plywood shield	"C" (cpm)	Difference	("B" - "C") (cpm)
Background (1)		Background (1)	N/A	Background (1)	N/A	N/A	N/A
Background (2)		Background (2)	N/A	Background (2)	N/A	N/A	N/A
Background (3)		Background (3)	N/A	Background (3)	N/A	N/A	N/A
Background (4)		Background (4)	N/A	Background (4)	N/A	N/A	N/A
Background (5)		Background (5)	N/A	Background (5)	N/A	N/A	N/A
Background (6)		Background (6)	N/A	Background (6)	N/A	N/A	N/A
Background (7)		Background (7)	N/A	Background (7)	N/A	N/A	N/A
Background (8)		Background (8)	N/A	Background (8)	N/A	N/A	N/A
Background (9)		Background (9)	N/A	Background (9)	N/A	N/A	N/A
Background (10)		Background (10)	N/A	Background (10)	N/A	N/A	N/A
Average ("A")						Average ("B" - "C	132.57

SUSBCR (concrete mt'ls) =Average ("A") _____ plus Average ("B" - "C") 132.57 cpm
SUSBCR (concrete mt'ls) = _____
SUSBCR (all other mt'ls) =Average ("A") _____
SUSBCR (all other mt'ls) = _____

Appendix D

Performance of Scans For Alpha and Beta Contamination

Performance of Alpha Scans Using the NE Electra

A) Prerequisites

1. The MDA for the instrument must be verified ≤ 50 dpm/100 cm2.

B) Procedure

1. Move the probe ≤ 2 inches/second within 0.25 inch of the surface.
2. If a single count is audibly detected, place the probe over the area where the count occurred.
3. Perform a stationary count for 5 seconds.
4. If a second count is audibly detected in this time period, perform a one minute PAT at this location.
5. Continue scan survey across surface.

C) Documentation

1. Record the location and result of all PATs that are equal to or exceed the Derived Concentration Guideline Level (DCGL).

Performance of Beta Scans Using the NE Electra

A1) Procedure for Performing Beta Scans Within Building 123 (SUSBCR ≤ 600 cpm)

1. Move the probe ≤ 1 inches/second within 0.5 inch of the surface.
2. If an audible increase in count rate is detected, place the probe over the area where the increase occurred.
3. Perform a stationary count for 10 seconds in the count rate mode.
4. If the presence of elevated activity is confirmed, perform a one minute PAT at that location.
5. Continue scan survey across surface.

A2) Procedure for Performing Beta Scans Within Building 123 (600 cpm < SUSBCR ≤ 1000 cpm)

1. Move the probe ≤ 0.5 inches/second within 0.5 inch of the surface.
2. If an audible increase in count rate is detected, place the probe over the area where the increase occurred.
3. Perform a stationary count for 20 seconds in the count rate mode.
4. If the presence of elevated activity is confirmed, perform a one minute PAT at that location.
5. Continue scan survey across surface.

A3) Procedure for Performing Beta Scans Exterior to Building 123

1. Move the probe ² 4 inches/second within 0.5 inch of the surface.
2. If an audible increase in count rate is detected, place the probe over the area where the increase occurred.
3. Perform a stationary count for 10 seconds in the count rate mode.
4. If the presence of elevated activity is confirmed, perform a one minute PAT at that location.
5. Continue scan survey across surface.

B) Documentation

1. Record the location and result of all PATs that are equal to or exceed the Derived Concentration Guideline Level (DCGL).

Attachment 1.0

Correspondence

DOE F 1325.8

United States Government **Department of Energy**

memorandum

Rocky Flats Field Office

DATE: DEC 5 1997

REPLY TO ATTN OF: AME:ESD:TPD:04909

SUBJECT: Surface Contamination Guidelines for Building 123

TO: Wynn A. Harding, Vice President
Safety Systems and Engineering
Kaiser-Hill Company, L.L.C.

Reference: Memo, Harding to Lowe, #97-RF-05729, subject: DOE Order 5400.5 Figure IV-1 - Surface Contamination Guidelines and the Application of These Limits Towards Naturally Radioactive Decay Chains and the Ingrowth of Progeny from Purified Naturally Occurring Radioisotopes - WAH-351-97, dtd 11/4/97

The DOE personnel in both the Assistant Manager for Engineering and the Assistant Manager for Performance Assessment offices have reviewed the referenced memorandum and the Safe Sites of Colorado Interoffice Correspondence "Derived Contamination Guide Level for Beta Contamination During Final Surveys of the Interior of Building 123 - JJM-111-97." Based on this review, I acknowledge and concur with the Kaiser-Hill Company, L.L.C.'s interpretation of DOE Order 5400.5 Figure IV-1, *Surface Contamination Guidelines* with regard to contamination resulting from naturally occurring radioactive decay chains and contamination from the ingrowth of progeny from purified naturally occurring radioisotopes (specifically natural Thorium and Th232).

This does not authorize any changes to release criteria established in Table 2-2 of DOE/EH-0256T U. S. Department of Energy Radiological Control Manual.

This technical direction is not intended to impact the cost, scope or schedule to the contract. If you believe there will be such an impact, you should immediately notify the Contracting Officer's Representative and the Contracting Officer and not implement the technical direction received. If you require additional information please contact me at extension 5878 or Tom Denny at extension 6619.

Keith A. Klein
Deputy Manager for Technical Programs

cc:
L. Lewis, AMGO, RFFO
T. Denny, ESD, RFFO
P. Psomas, TAD, RFFO
D. Parsons, SHFSD, RFFO

Safe Sites OF COLORADO, L.L.C.

Rocky Flats Environmental Technology Site

INTEROFFICE CORRESPONDENCE

DATE: November 18, 1997

TO: File

FROM: J. J. Miller, Radiological Engineering, Bldg. T130B, X2454

SUBJECT: DERIVED CONTAMINATION GUIDE LEVEL (DCGL) FOR BETA CONTAMINATION DURING FINAL SURVEYS OF THE INTERIOR OF BUILDING 123 - JJM-111-97

During reconnaissance level characterization surveys, fixed beta contamination was detected in the building hallways and in some of the laboratories. With levels up to 124,000 dpm /100 cm^2, Room 105 was determined to be the most highly contaminated area in the building. It is assumed that the contamination identified in the hallways originated in Room 105 and was spread throughout the building via personnel. Interviews with building occupants suggested that research with thorium had occurred in Room 105 approximately 10 to 12 years prior. In-situ gamma spectroscopy identified the presence of Th-232 through the measurement of Ac-228, its second decay product. While Th-232 is an alpha emitter, there was no alpha contamination detected in areas with elevated beta contamination. This leads to two possibilities: (1) Th-232 is not present and the source of contamination is from Ra-228, a low energy beta emitter and parent to Ac-228, or (2) the activity that was once dispersed across the floor tiles had been worn off through years of foot traffic and the only activity remaining is confined to the floor tile joints where a collection of dirt completely attenuate the Th-232 alpha but does not attenuate the beta particles emitted from Ac-228. The second scenario is most likely in that, the historical site assessment did not identify the use of Ra-228 in past building processes and the contamination pattern follows the tile joints.

Gross alpha contamination surveys will be used to verify the building is free of contamination resulting from Pu-239. Since the release criteria for Pu-239 is an order of magnitude less than the Th-232 release criteria and the alpha particles emitted from Th-232 have gone undetected, an alternative method of verifying the release criteria for Th-232 is needed in order to complete final surveys. Assuming Th-232 was present in a purified form, the Th-232 activity can be calculated knowing the time it has decayed and the Ac-228 activity. The Th-232 release criteria will be verified by measuring the beta emission from the Ac-228 and applying a correction factor that accounts for the incomplete ingrowth of Ac-228 from Th-232 to the Th-232 release criteria. A factor of 0.75 has been applied based on the activity ratio calculated using RadDecay Version 4.0, output attached. This factor is conservative in that it assumes all of the activity was deposited between 10 to 12 years ago from a single incident. This assumption does not take into account the ingrowth of Ac-228 which would have occurred if the Th-232 contamination resulted from a series of events occurring over the duration of Th-232 use.

Attachments As
Stated (2)

jjm

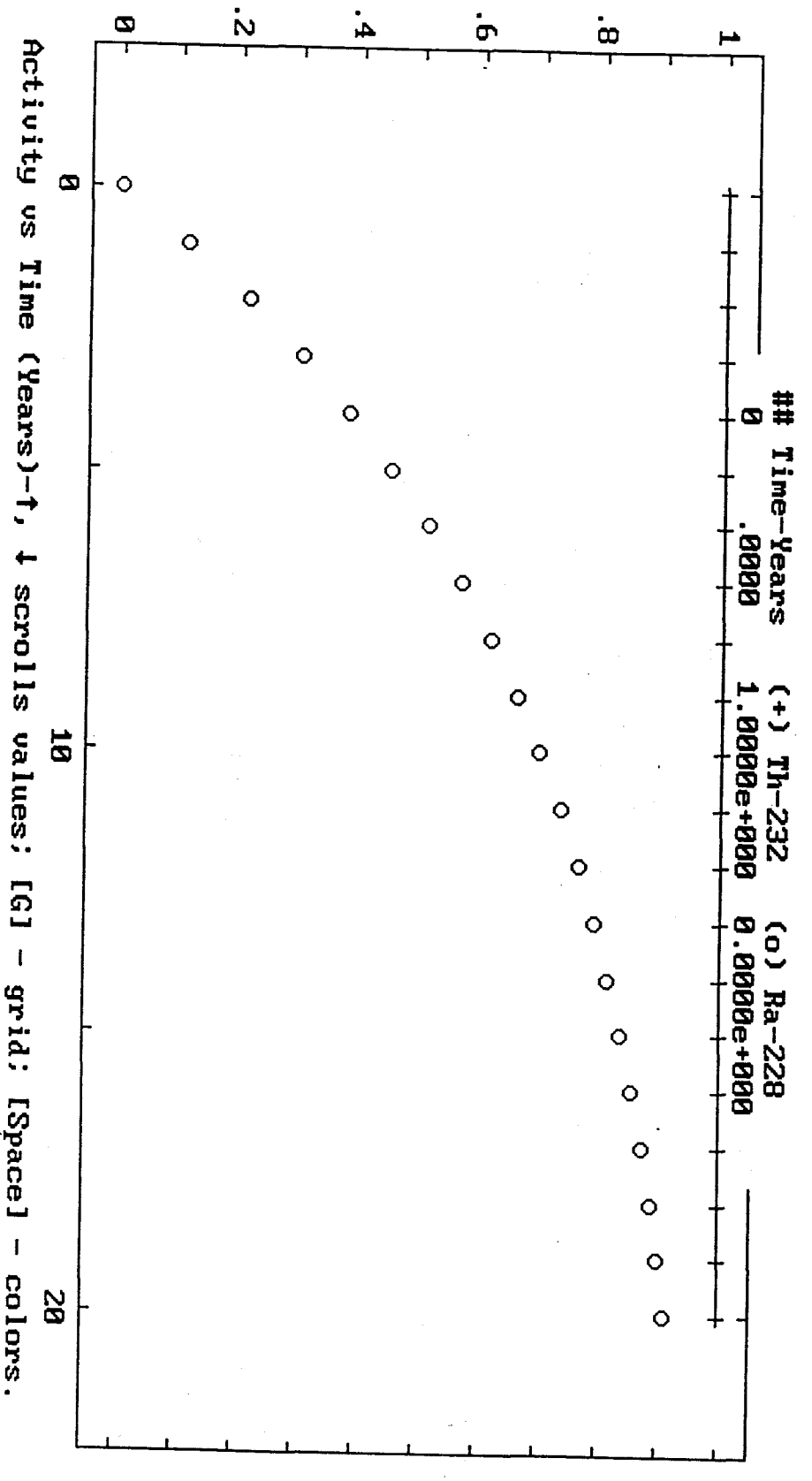
cc:
J. B. Barroso
R. D. Johnson

Result of decaying 1 Curie of Th-232
Decay time of 10 years = 3,652.50 days

Nuclide	HalfLife	Branching from parent	Fraction	Curies
Th-232	1.4050e+010 Years	[parent]	1.0000e+000	1.0000e+000
Ra-228	5.7500e+000 Years	1.00000	7.0045e-001	7.0045e-001
Ac-228	6.1300e+000 Hours	1.00000	7.0041e-001	7.0041e-001
Th-228	1.9132e+000 Years	1.00000	5.6435e-001	5.6435e-001
Ra-224	3.6200e+000 Days	1.00000	5.6364e-001	5.6364e-001
Rn-220	5.5610e+001 Seconds	1.00000	5.6364e-001	5.6364e-001
Po-216	1.4600e-001 Seconds	1.00000	5.6364e-001	5.6364e-001
Pb-212	1.0643e+001 Hours	1.00000	5.6355e-001	5.6355e-001
Bi-212	6.0550e+001 Minutes	1.00000	5.6355e-001	5.6355e-001
Tl-208	3.0530e+000 Minutes	.35930	2.0248e-001	2.0248e-001
Po-212	2.9800e-007 Seconds	.64070	3.6106e-001	3.6106e-001

Result of decaying 1 Curie of Th-232
Decay time of 12 years = 4,383.00 days

Nuclide	HalfLife	Branching from parent	Fraction	Curies
Th-232	1.4050e+010 Years	[parent]	1.0000e+000	1.0000e+000
Ra-228	5.7500e+000 Years	1.00000	7.6462e-001	7.6462e-001
Ac-228	6.1300e+000 Hours	1.00000	7.6459e-001	7.6459e-001
Th-228	1.9132e+000 Years	1.00000	6.5366e-001	6.5366e-001
Ra-224	3.6200e+000 Days	1.00000	6.5309e-001	6.5309e-001
Rn-220	5.5610e+001 Seconds	1.00000	6.5309e-001	6.5309e-001
Po-216	1.4600e-001 Seconds	1.00000	6.5309e-001	6.5309e-001
Pb-212	1.0643e+001 Hours	1.00000	6.5302e-001	6.5302e-001
Bi-212	6.0550e+001 Minutes	1.00000	6.5301e-001	6.5301e-001
Tl-208	3.0530e+000 Minutes	.35930	2.3463e-001	2.3463e-001
Po-212	2.9800e-007 Seconds	.64070	4.1838e-001	4.1838e-001


Time-Years (+) Th-232 (o) Ra-228
0 1.0000e+000 0.0000e+000
.0000
1
.8
.6
.4
.2
0
0
10
20
Activity vs Time (Years)-↑, ↓ scrolls values; [G] - grid; [Space] - colors.

CORRES. CONTROL
OUTGOING LTR. NO.

)E ORDER #5400.5

)7-RF-05729

DIST.	LTR	ENC
NSUSSEN, S. J.		
ORD, M. D.		
R.		
RDGE, L.		
RD, R. G.		
RRERA, D. W.		
L, J. A.		
LL, R. E.		
RTINEZ, L. A.		
RKER, A. M.		
EARS, M. S.	X	
LER, R. E.		
OR, N. R.		
ORHEIS, G. M.		
rr, K. A.	X	
rroso, J. B.	X	
rward, D. J.	X	
itland, R. B.	X	
ler, J. J. MILLER	X	
orley, P. D.	X	
...ding, W. A.	X	
RRES.CONTROL	X	X
MIN RECRD/080		
AFFIC		
TS/T130G		

CLASSIFICATION:	
NI	X
CLASSIFIED	X
NFIDENTIAL	
CRET	

THORIZED CLASSIFIER SIGNATURE:
te: 11/3/97 a/NU

REPLY TO RFP CC NO.:

ACTION ITEM STATUS:
PARTIAL/OPEN
CLOSED

LTR APPROVALS:

ORIG. & TYPIST INITIALS:
JJM/cjb

6 . 2/28/97)

KAISER•HILL
COMPANY

November 4, 1997

97-RF-05729

David C. Lowe
Assistant Manager for Engineering
DOE, RFFO

DEPARTMENT OF ENERGY (DOE) ORDER 5400.5 FIGURE IV-1 - SURFACE CONTAMINATION GUIDELINES AND THE APPLICATION OF THESE LIMITS TOWARDS NATURALLY RADIOACTIVE DECAY CHAINS AND THE INGROWTH OF PROGENY FROM PURIFIED NATURALLY OCCURRING RADIOISOTOPES - WAH-351-97

Kaiser-Hill requests that DOE, RFFO acknowledge and concur with Kaiser-Hill's interpretation of DOE 5400.5 Figure IV-1, *Surface Contamination Guidelines*. When the release limits for parent isotopes differ from that of their progeny, clarification is necessary to ensure the appropriated limits are utilized.

Kaiser-Hill's interpretation applies to facilities and equipment having residual surface contamination resulting from naturally occurring radioactive decay chains and from the ingrowth of progeny from purified naturally occurring radioisotopes. Of specific concern is natural thorium (Th-nat) and Th-232 which have been detected in Building 123 during the characterization survey.

To assure that the public and environment are protected from radioactive material at DOE facilities, the DOE promulgated DOE Order 5400.5. This Order applies to radioactive material released from operating DOE facilities and also to radioactive material left in place after a DOE facility has been decommissioned. Section IV, 4. a. of this Order provides generic guidelines for residual concentrations of Ra-226, Ra-228, Th-230 and Th-232 in soil. These guidelines take into account ingrowth of radium from thorium and assume secular equilibrium between the two. Section IV, 4. d. of this Order applies to surface contamination of existing structures and equipment. Generic surface contamination guidelines provided in Figure IV-1 fail to consider the secular equilibrium condition between Th-232 and Ra-228.

Kaiser-Hill interprets the allowable total residual surface contamination limits for Th-nat and Th-232 to include associated progeny. This interpretation is based on:

1. The allowable total residual surface contamination limits for Th-nat and Th-232 are an order of magnitude greater than thorium progeny, specifically Ra-228 and Th-228, which will be in or approaching secular equilibrium.

2. The limits associated with U-nat, U-235 and U-238 include associated decay products.

Kaiser-Hill Company, L.L.C.
Courier Address: Rocky Flats Environmental Technology Site, State Hwy. 93 and Cactus, Rocky Flats, CO 80007 • 303.966.7000
Mailing Address: P.O. Box 464, Golden, Colorado 80402-0464

3. This interpretation is consistent with the generic guidelines for residual concentrations of Ra-226, Ra-228, Th-230 and Th-232 in soil.

To release Building 123 for unrestricted use, alpha contamination will be verified less than the Category 1 release criteria of Figure IV-1 (20 dpm/100 cm^2 removable, 100 dpm/100 cm^2 total average and 300 dpm/100 cm^2 total maximum) which will be indicative of the residual radioactivity resulting from transuranic radionuclides. To account for the incomplete ingrowth of Th-232 progeny, beta contamination will be verified less than 75% of the Category 2 release criteria of Figure IV-1; (200 dpm/100 cm^2 removable, 1000 dpm/100 cm^2 total average and 3000 dpm/100 cm^2 total maximum), which will be indicative of the residual radioactivity resulting from Th-232 and Th-nat, through the measurement of Ac-228 in or approaching secular equilibrium with Ra-228 and Th-232.

It is requested that DOE, RFFO acknowledge and concur with this interpretation as soon as possible so that the Building 123 Deactivation and Decommission project can move forward. If you have any questions, please contact J. J. Miller at Extension 2454, or J. B. Barroso at Extension 8451.

Wynn A. Harding
Vice President
Safety Systems & Engineering

JJM:cjb

Orig. and 1 cc - D. C. Lowe

Author: JohnJ Miller at charlie12
Date: 3/17/98 2:48 PM
Priority: Normal
CC: Jeff Barroso at Kilo20
TO: Mark Mattheiss at Golf16
Subject: B123 Background determination
---------- Message Contents ----------

Mark,

Based on the actual density (0.606 g/cm^3) of the plywood being used for the determination of the SUSBCR, the calculated thickness of plywood required to completely shield the Y-90 beta is 0.715 inch. Therefore, the backgrounds performed with 0.75 inch thickness are valid.

Also, statistical analysis performed on 230 background data points obtained in building 551 will allow for use to cease obtaining daily reference area backgrounds. The following values will be recorded for the Average (B-C) block. For alpha, Average (B-C) = 1.42 cpm. For beta Average (B-C) value = 132.57 cpm. I talked with Chip and made up some forms with the values pre-recorded.

Any questions, give me a call.

John Miller

Author: JohnJ Miller at charlie12
Date: 3/16/98 4:37 PM
Priority: Normal
TO: Mark Mattheiss at Golf16
CC: Jeff Barroso at Kilo20
Subject: Background for B123 Final Surveys.
---------- Message Contents ----------

Mark,

Appendix C of the Close-out Radiological Survey Plan for the Building 123 Cluster, Revision 3, specifies the procedure to obtain the SUSBCR. Plywood is identified as the material to use to as the shield in order to determine the background contribution due to concrete. Plywood was chosen because it is 1) readily available, 2) the effect due to bremsstrahlung is negligable and 3) it is free of static charge. The thickness of the plywood was determined assuming a density of 0.5 g/cm^3 and an Emax (E) of 2.28 Mev (Y-90 beta) and then calculating the range (R) of this beta using: $R = 0.412E^{(1.265 - 0.0954\ln E)}$.

In order to validate the backgrounds obtained, the density of the plywood needs to be determined. When the actual plywood density is determined, the thickness required to shield the Y-90 beta will be recalculated.

John Miller

RMRS Rocky Mountain Remediation Services, L.L.C.
. . . protecting the environment

INTEROFFICE MEMORANDUM

DATE: March 24, 1998

TO: FILE

FROM: J. J. Miller, Radiological Engineering, Bldg. T130B, X2454

SUBJECT: SURVEY UNIT SPECIFIC BACKGROUND COUNT RATE (SUSBCR) DETERMINATION FOR BUILDING 123 FINAL SURVEYS JJM-11-98

Appendix C of the Close-out Radiological Survey Plan for the Building 123 Cluster, Revision 3, provides instructions for obtaining a SUSBCR. Following radiological engineering analysis of 230 data points collected during the reference area background determination, standard values for alpha and beta reference area (shielded - unshielded) background will be applied. These values are 132.57 cpm beta and 1.42 cpm alpha. Refer to the attached worksheets.

Summary of Reference Area Background Statistical Analysis

	Alpha (unshielded - shielded)	Beta (unshielded - shielded)
Mean (x)	1.04	127.07
Standard Deviation (σ)	3.46	50.40
sample size (n)	230	230
degrees of freedom (df)(n-1)	229	229
$t_{95\%}$	1.645	1.645
$\mu_{\alpha} = x + (t_{1-a,df})(\sigma/(n)^{1/2})$	1.42	132.57

Frequency distributions for both the alpha and beta reference area background are attached.

Concern has been raised over the validity of the final surveys of the exterior survey units because these surveys were performed prior to initiating a reference area background. Not applying the reference area background to the exterior survey units increases the probability of incorrectly failing to release a survey unit (Type II error), a conservative failure, therefore, the final surveys completed in exterior survey units are valid.

Contact me with questions regarding this memo.

jjm

Attachments:
As Stated

cc:

J. B. Barroso
K. A. Dorr
C. L. Guthrie
M.B. Mattheiss

Survey Unit Specific Background Count Rate Calculation Sheet

Survey Unit:		Date:		RCT Initial:			Alpha
Instrument:		Serial #:					
Survey Unit (plywood shield)	A (cpm)	Reference Area (unshielded)	B (cpm)	Reference Area (plywood shield)	C (cpm)	Difference	B - C (cpm)
Background (1)		Background (1)	N/A	Background (1)	N/A	N/A	N/A
Background (2)		Background (2)	N/A	Background (2)	N/A	N/A	N/A
Background (3)		Background (3)	N/A	Background (3)	N/A	N/A	N/A
Background (4)		Background (4)	N/A	Background (4)	N/A	N/A	N/A
Background (5)		Background (5)	N/A	Background (5)	N/A	N/A	N/A
Background (6)		Background (6)	N/A	Background (6)	N/A	N/A	N/A
Background (7)		Background (7)	N/A	Background (7)	N/A	N/A	N/A
Background (8)		Background (8)	N/A	Background (8)	N/A	N/A	N/A
Background (9)		Background (9)	N/A	Background (9)	N/A	N/A	N/A
Background (10)		Background (10)	N/A	Background (10)	N/A	N/A	N/A
Average (A)						Average (B - C)	1.42

SUSBCR(concrete materials) = Average (A)_____ + Average (B - C)_____1.42_____

SUSBCR(concrete materials) = _____

SUSBCR(all other materials) = Average (A)_____

SUSBCR(all other materials) = _____

Survey Unit Specific Background Count Rate Calculation Sheet

Survey Unit:		Date:		RCT Initial:			Beta
Instrument:		Serial #:					
Survey Unit (plywood shield)	A (cpm)	Reference Area (unshielded)	B (cpm)	Reference Area (plywood shield)	C (cpm)	Difference	B - C (cpm)
Background (1)		Background (1)	N/A	Background (1)	N/A	N/A	N/A
Background (2)		Background (2)	N/A	Background (2)	N/A	N/A	N/A
Background (3)		Background (3)	N/A	Background (3)	N/A	N/A	N/A
Background (4)		Background (4)	N/A	Background (4)	N/A	N/A	N/A
Background (5)		Background (5)	N/A	Background (5)	N/A	N/A	N/A
Background (6)		Background (6)	N/A	Background (6)	N/A	N/A	N/A
Background (7)		Background (7)	N/A	Background (7)	N/A	N/A	N/A
Background (8)		Background (8)	N/A	Background (8)	N/A	N/A	N/A
Background (9)		Background (9)	N/A	Background (9)	N/A	N/A	N/A
Background (10)		Background (10)	N/A	Background (10)	N/A	N/A	N/A
Average (A)						Average (B - C)	132.57

SUSBCR(concrete materials) = Average (A)_____ + Average (B - C)__132.57__

SUSBCR(concrete materials) = _____

SUSBCR(all other materials) = Average (A)_____

SUSBCR(all other materials) = _____

Atachment 3 of 4
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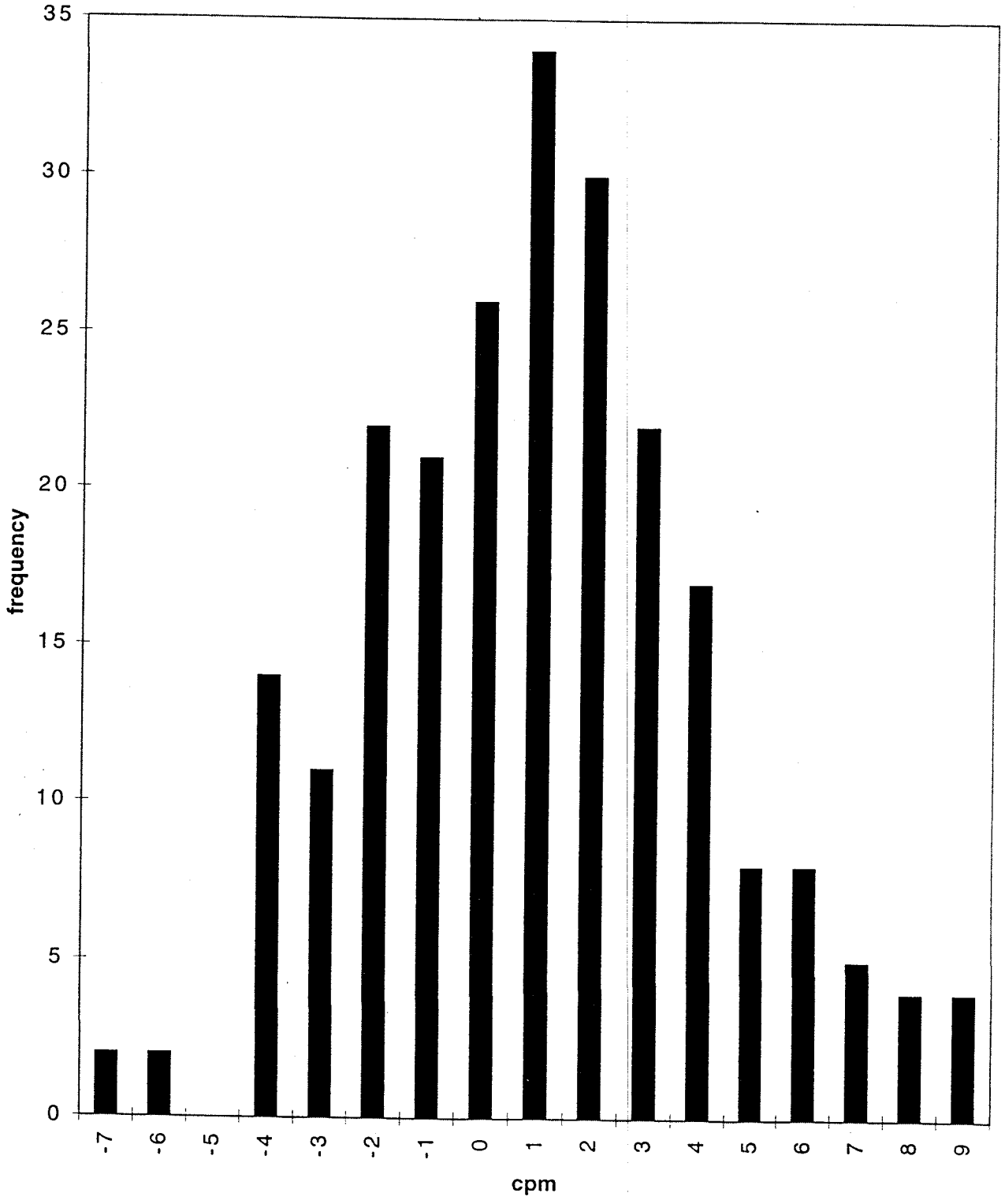
Alpha Background Building 551



Attachment 4 of 4
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Beta Background Building 551